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(54) Fluid filter

(57) An activated carbon filter element for filtering air and other gaseous fluids comprises a layer (10) of cellular material the cells (34) of which extend from one face (12) of the layer to the other face (14) and contain activated carbon particles or granules (36), in which fluid-permeable screens (30, 32) to prevent the loss of carbon particles or granules from the cells while permitting fluid-flow through them are bonded directly to both faces (12, 14) of the cellular layer (10) by a bonding material applied to those faces in liquid form without heating during manufacture of the filter element, the bonding material being applied in sufficient quantity that it also serves as a reinforcement (cornices 38) for the cellular material (10) with the result that a metal grille or other such reinforcement is rendered unnecessary.

Fig.1.

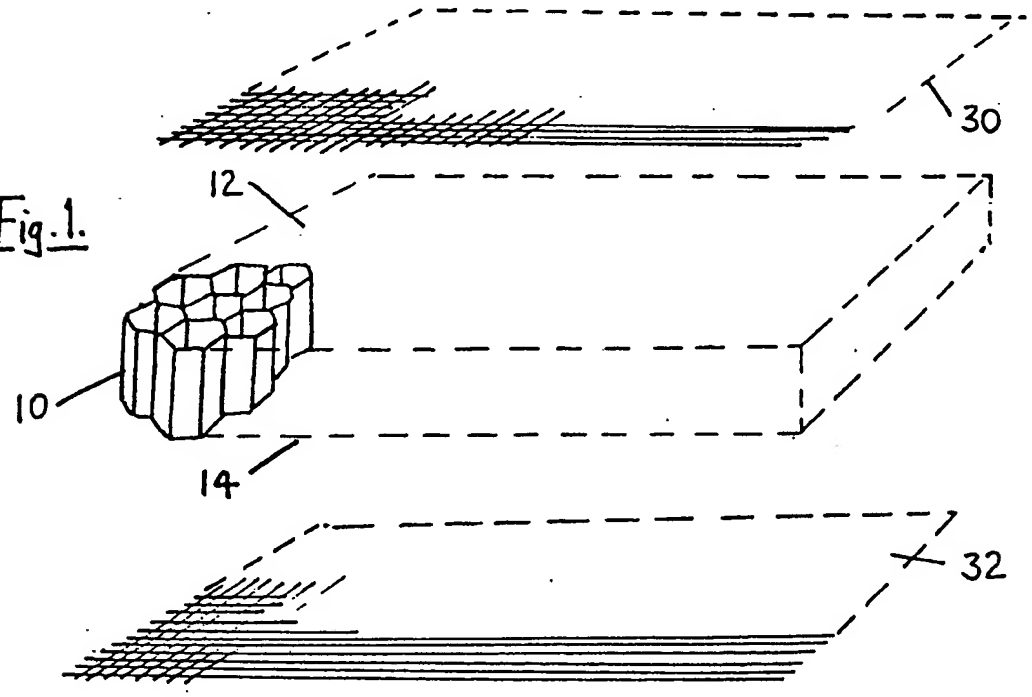
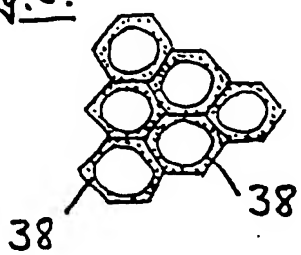


Fig.5.



The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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Fig.1.

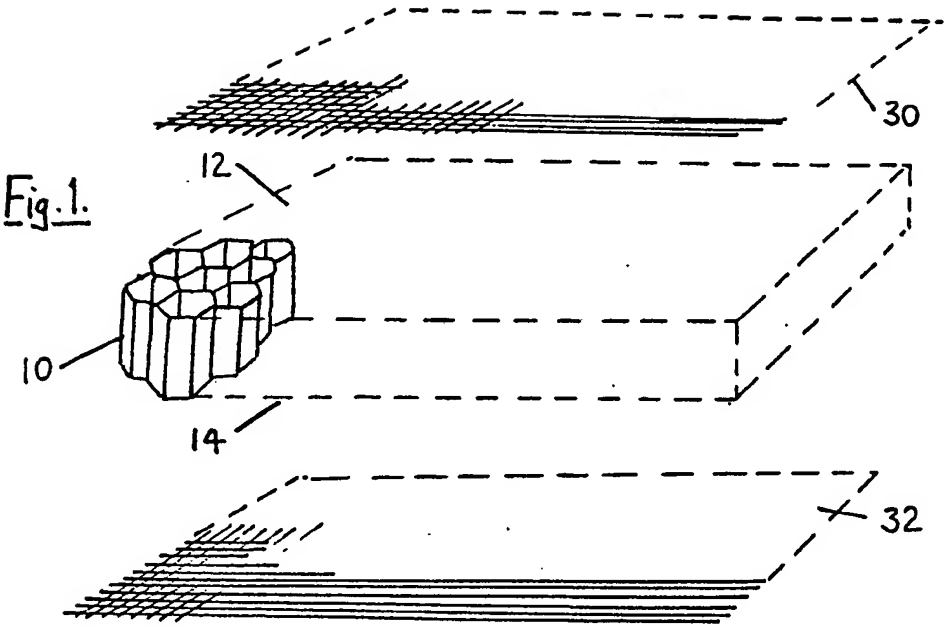


Fig.2.

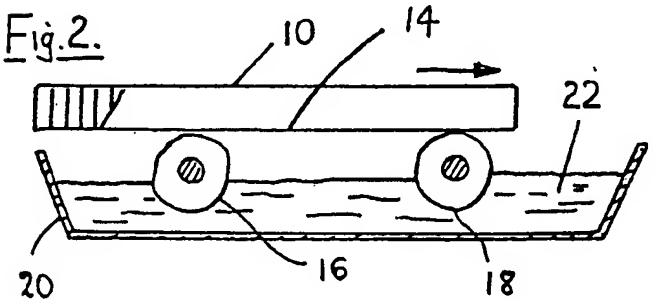


Fig.5.

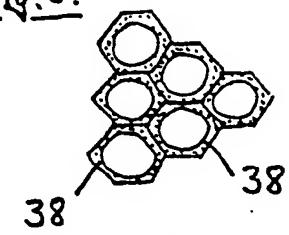


Fig.3.

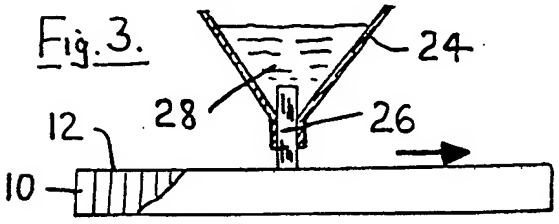


Fig.4.

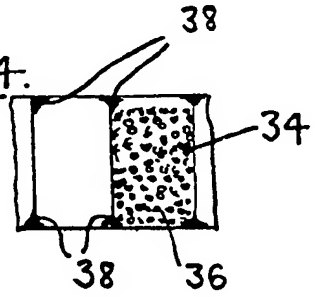


Fig.6.

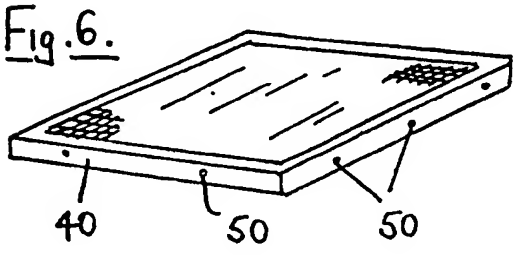
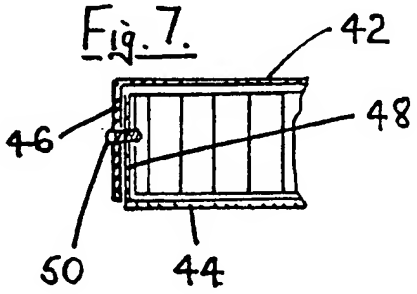


Fig.7.



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Fluid Filter

This invention relates to activated carbon filters and filtering elements for filtering air and other gaseous fluids so as to remove noxious substances contained in such fluids.

In a number of prior Patents, I have described activated carbon filter elements comprising a layer of cellular material the cells of which contain activated carbon particles or granules. To prevent the carbon particles or granules from coming out of the cells, the ends of the latter are closed by fluid-permeable screens which are bonded to the faces of the cellular layer by the interposition of metal grilles composed of criss-crossing metal rods. During manufacture of these filter elements, the metal grilles are heated and then dipped in a thermoplastics powder which immediately melts due to the heat contained in the grilles so as to form a molten layer thereon. In this state, the grilles are applied to the two faces of the cellular layer, and the fluid-permeable screens are then applied to the grilles. When therefore the molten thermoplastic material on the grilles hardens, it serves to bond the grilles and the fluid-permeable screens to the cellular layer.

Filter elements made by this method have proved very effective in use, and large numbers of them have been sold. However, the use of metal grilles and the necessity

to heat them during manufacture of the filter elements increases the cost of producing the filter elements and it is therefore an aim of the present invention to produce an equivalent form of activated carbon filter more cheaply.

With this aim in view, the present invention is directed to an activated carbon filter element for filtering air and other gaseous fluids comprising a layer of cellular material the cells of which extend from one face of the layer to the other face and contain activated carbon particles or granules, in which fluid-permeable screens to prevent the loss of carbon particles or granules from the cells while permitting fluid-flow through them are bonded directly to both faces of the cellular layer by a bonding material applied to those faces in liquid form without heating during manufacture of the filter element, the bonding material being applied in sufficient quantity that it also serves as a reinforcement for the cellular material with the result that a metal grille or other such reinforcement is rendered unnecessary.

An example of an activated carbon filter element in accordance with the invention is illustrated in the accompanying drawing, in which -

Figure 1 is an exploded perspective view of the filter element during its manufacture;

Figure 2 is a diagrammatic vertical section through means for applying a coating of liquid bonding material to the cellular layer of the filter element;

Figure 3 is a view similar to Figure 2 showing an alternative means for applying the liquid bonding material to the cellular material;

Figure 4 is an enlarged vertical section through a small part of the cellular layer after the bonding material has been applied and fluid-permeable screens have been attached to both faces of the cellular layer;

Figure 5 is a plan view of a small part of the cellular layer after the liquid bonding material has been applied to the cellular layer;

Figure 6 is a reduced perspective view of the completed filter element; and

Figure 7 is an enlarged vertical section through a small part of the completed filter element shown in Figure 6.

Figure 1 shows a layer 10 of cellular material which is readily available commercially. Normally it is made of a treated Kraft paper or other such cellulosic material, but it could equally well be made of metal where the filter element is to be used in high-temperature applications. For example, the cellular layer 10 could be made of aluminium or stainless steel. Whatever material is used, it will be noted that the cells are of hexagonal section and extend from one face 12 of the layer to the other face 14. In this particular instance, the axes of the cells lie at right-angles to the faces 12 and 14, but in other instances they could lie at angles other than 90

degrees to those faces.

During manufacture of the filter element, the cellular layer 10 has a coating of liquid bonding material applied to one of its faces 12 or 14. This can be done in various ways, according to choice. Merely by way of example, Figures 2 and 3 show two practical ways of applying the coating. In Figure 2, the lower face 14 of the cellular layer 10 passes over and in contact with two rollers 16 and 18 which are partially immersed in a bath 20 of liquid bonding material 22. Alternatively, the cellular layer 10 can be passed beneath a trough or container 24 as shown in Figure 3 so that a wick or brush 26 extending through an opening in the lower part of the container 24 becomes saturated with liquid bonding material 28 within the container and thus applies it to the upper face 12 of the cellular layer as the latter is moved past the container. By both these methods, a coating of liquid bonding material is applied to one face of the cellular layer.

Immediately that has been done - and while the bonding material is still liquid - a fluid-permeable screen 30, 32 is applied to the respective coated face 12, 14 of the cellular layer 10. The fluid-permeable screens will generally be of woven glassfibre material which has good resistance to corrosion and rises in temperature, but other woven fabrics of, say, nylon or other synthetic plastics fibres, can be used instead as well as foam layers and woven metal wire.

The liquid bonding material now hardens so as to bond the respective fluid-permeable screen 30 or 32 to the cellular layer 10. Unlike the method used in earlier forms of activated carbon filter elements where a hot liquid coating is produced during manufacture of the elements, the liquid bonding material in this instance is applied cold without the use of any intermediate metal grille or other such reinforcement. The bonding material will therefore generally be one of the commercially-available compounds which sets hard on being mixed with an appropriate quantity of hardener. For example, the bonding material can be a polyurethane, polyester or epoxy resin compound, or a commercial product like Araldite, all of which compounds are applied in liquid form after being mixed with a hardener.

Once the cellular layer 10 has had one fluid-permeable screen 30 or 32 applied to it and the bonding material has hardened, it becomes possible to fill the cells of the cellular layer with activated carbon particles or granules as shown in the cell 34 illustrated in Figure 4. Once all the cells have been thus filled, a coating of liquid bonding material is applied to the other face of the cellular layer 10, and the other fluid-permeable screen 30 or 32 is applied to that face. Once the second coating of bonding material has hardened, it will then be found that both fluid-permeable screens 30 and 32 are firmly bonded to the respective faces 12 and 14 of the celular layer 10 so as to trap the activated carbon particles or

granules 36 within the cells.

In applying the coatings of liquid bonding material to the two faces 12 and 14 of the cellular layer, it is necessary to apply such a quantity of the bonding material that it forms cornices 38 of bonding material at the tops and bottoms of each cell as shown in Figure 4. These cornices extend right round the upper and lower edges of each cell as shown in Figure 5. Because the cornices of each cell are integrally formed with the cornices of adjacent cells, the hardened bonding material on the faces 12 and 14 of the cellular layer forms, in effect, grilles equivalent to the metal grilles previously used. In other words, the bonding material not only serves to bond the fluid-permeable screens 30 and 32 to the cellular layer but it also forms stiff reinforcements in place of the metal grilles hitherto used in such filter elements. The prouction of these filter elements is therefore made much less expensive and an added advantage is that no heating is required when applying the fluid-permeable screens 30 and 32 to the cellular layer 10.

Although the filter element shown in the drawing shows only one cellular layer 10, it is to be understood that many filter elements made in accordance with the invention will have two or more such layers 10 superimposed one on top of each other with a fluid-permeable screen between each layer. Where two or more such layers of cellular material are sandwiched together, the axes of the

cells in one layer will be out of alignment with the axes of the cells in the other layer to increase the scrubbing effect by the activated carbon particles or granules as fluid passes through the filter element.

Figures 6 and 7 illustrate the manner in which a metal frame 40 can be attached to the cellular layer 10 once the screens 30 and 32 have been bonded to it. The metal frame 40 is preferably in two parts 42 and 44 as shown in Figure 7, the said two parts being provided with respective side flanges 46 and 48 which overlap each other and which are fixed together by rivets 50 or other appropriate fasteners at spaced-apart points along the two flanges.

Claims

1. An activated carbon filter element for filtering air and other gaseous fluids comprising a layer of cellular material the cells of which extend from one face of the layer to the other face and contain activated carbon particles or granules, in which fluid-permeable screens to prevent the loss of carbon particles or granules from the cells while permitting fluid-flow through them are bonded directly to both faces of the cellular layer by a bonding material applied to those faces in liquid form without heating during manufacture of the filter element, the bonding material being applied in sufficient quantity that it also serves as a reinforcement for the cellular material with the result that a metal grille or other such reinforcement is rendered unnecessary.

2. A filter element according to claim 1, in which the layer of cellular material is made of a treated Kraft paper or other cellulosic material.

3. A filter element according to claim 1 or claim 2, in which the bonding material comprises a polyurethane, polyester, epoxy resin or other such compound which sets hard after being applied in liquid form in admixture with a hardener.

4. A filter element according to any one of claims 1-3, in which the bonding material forms cornices at the tops and bottoms of the cells in the cellular layer.

5. A filter element according to claim 4, in which the cornices extend right round the upper and lower edges of each cell and are integrally formed with the cornices of adjacent cells.

6. A filter element according to any preceding claim, in which the cellular layer and the screens are surrounded by a metal frame made in two parts, the two parts being provided with respective side flanges which overlap each other and are fixed together by rivets or other fasteners at spaced-apart points along the two flanges.

7. A filter element according to any preceding claim, in which the fluid-permeable screens are made of woven glassfibre material, a woven fabric of nylon or other synthetic plastics fibres, woven metal wire or a foamed material.

8. A filter element according to claim 1 substantially as described herein with reference to the accompanying drawing.

9. A method of making a filter element as claimed in claim 1, wherein the bonding material is applied to the layer of cellular material by causing a face thereof to make contact with at least one roller which is partially immersed in a bath of liquid bonding material or to pass beneath a trough or other container so that a wick or brush extending through an opening in the lower part of the container becomes saturated with liquid bonding material within the container and thus applies it to the face of the cellular layer as the latter is moved past the container.

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